



ORIGINAL ARTICLE

Minimal invasive pyeloplasty technique with vertical surgical approach: An alternative to laparoscopic pyeloplasty

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Abstract This retrospective clinical study presents pyeloplasty results following a muscle-splitting dissection, with mini-flank incision, using instruments held in a vertical position. Between 2004 and 2010, dismembered pyeloplasty (Anderson-Hynes) was performed in 37 cases (32 males and 5 females) with an average age of 26 years (range, 20–56 years). The technique was carried out through a window opened by separating the lateral abdominal muscles. Operation duration, length of incision, postoperative pain, complications, and radiological and clinical results were discussed. The operation duration was between 50 and 90 minutes (average = 65 minutes), the incisional length 5 and 7 cm (average = 5.2 cm), and visual pain scale was 4.1 ± 3.1 and 3.3 ± 3.4 at 4 and 24 hours after the operation, respectively. The duration of hospitalization was between 30 and 120 hours (average = 42 hours). In a retrospective analysis of our study, one case was reoperated on, following recurrence with obstruction, there were 9 cases with prolonged dilation in response to diuretics and 29 cases with complete recovery. Pyeloplasty operations, with a vertical surgical approach through smaller incisions and muscle separation, offered shorter periods of hospitalization, less postoperative pain, acceptable cosmetic results and higher rates of functional recovery.

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Introduction

The objective of pyeloplasty is to repair ureteropelvic junction obstruction (UPJO) with the best functional

results. There is a success rate of 90% with open pyeloplasty.

Improvements in endourology have revealed alternatives to open surgery, percutaneous antegrade endopyelotomy and retrograde endopyelotomy, with smaller success rates [1]. Laparoscopic pyeloplasty is gradually being considered to be an alternative to open surgery, but longer operation durations and a long surgical training requirement prevents

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it from being performed as a routine procedure at most medical centers. Consequently, open surgery still largely remains the chosen procedure [2].

In this study, we evaluated the results of pyeloplasty operations performed with a vertical surgical approach, through a small incision and muscle separation.

Material and methods

Between 2004 and 2010, 37 operated cases with dismembered pyeloplasty due to congenital UPJO were retrospectively examined. Blood urea and creatinine levels, urine culture, intravenous excretory urography (IVU), and diuretic renogram, with diethylenetetraamine pentaacetic acid (DTPA), were performed prior to the operation. All cases were operated on with the same surgical method explained below. Operation and hospitalization durations, length of incision, and pain assessment with the visual analogue pain scale, were recorded. Patients were asked to evaluate their pain scale between 0 (no pain) and 10 (maximum pain), 4 and 24 hours after the operation. Intramuscular or oral diclofenac diethylammonium 100 mg (Voltaren, Novartis Pharma, Istanbul, Turkey) was administered for postoperative analgesia. Patients with oral intake and comfortable mobilization, without drainage, were discharged. The upper urinary system was evaluated 2 months after the operation with renal ultrasonography. Outcomes were analyzed 6 months after the operation, with IVU and DTPA renal scintigraphy. The line of incision was examined in terms of incisional hernia.

Surgical procedure

Patients were operated on under the lateral decubitus position, leaning backwards slightly. Operations were initiated with a 5 cm mini flank incision and performed to the depth with a vertical surgical approach. The retroperitoneal area was accessed below the 12th costal margin, following separation of the external oblique, internal oblique and transverse muscles with retractors. No muscles

were incised under any circumstances. The length of incision was extended up to 7 cm in cases where the initial incision was inadequate. A fine drain tube (18–20 F) was placed in the retroperitoneal area in all cases and removed on the 2nd postoperative day. Muscles were not sutured. Only muscle aponeurosis was closed with 4/0 polyglactin sutures. Diluted bupivacaine (20–30 ml, 50%) (Marcain Flakon, AstraZeneca Pharma) was injected subcutaneously for postoperative analgesia. The skin was closed subcutaneously with 4/0 self-dissolving sutures.

Vertical method

Handling of surgical instruments by this method is demonstrated in Fig. 1. The handles of the surgical instruments are gripped with the thumb and index fingers of both the dominant and secondary hands. Thus, surgical instruments could be manipulated at an angle close to 90 degrees. Hand trembling is minimized by placing both elbows and hands on the patient. Bending over the operating table to achieve a view is, therefore, not necessary, and this approach allows dissection and suturing in a deep area through a small window.

Dismembered pyeloplasty method

The ureter was initially located and suspended. The renal pelvis was exposed with obtuse and sharp dissections. The kidney was mainly unreleased. Obstruction of the ureteropelvic junction and presence of aberrant vessels was exposed and a full incision of the ureteropelvic junction was performed. The fibrotic upper end of the ureter was excised, and at least 2 cm spatulation was performed. Reduction was performed in cases with extreme pelvic dilatation. Mucosal edges were inverted and sutured with juxtapositioning of the adventitia with 5/0 or 6/0 polyglactin acid suture for ureteropelvic anastomosis.

Urinary drainage was achieved with 6 French double j ureteral stents in all patients. The ureteral stent catheter

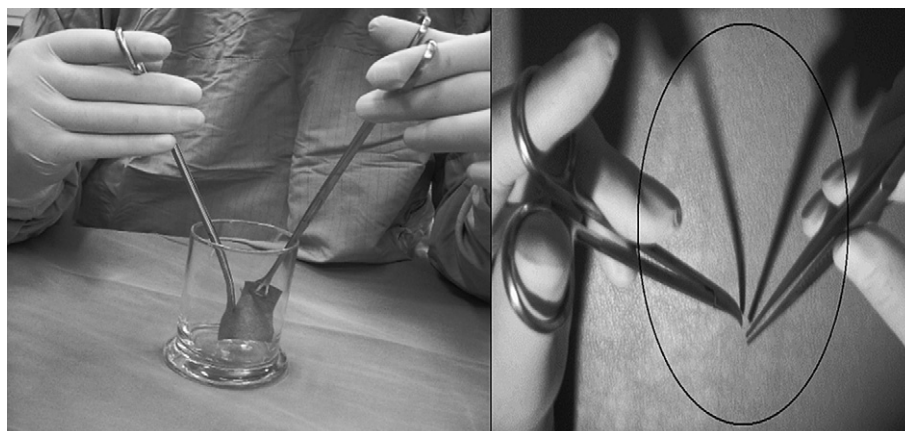


Figure 1. Handling of surgical instruments in Vertical method. The angle between the two surgical instruments is wider in the traditional handling. Additionally, a wider surgical area is needed and hand trembling could not be minimized. In the vertical method, the instrument is gripped with the thumb and index fingers to work in the deep area through a small window with minimizing the hand trembling.

was removed postoperatively between the 20th and 35th days.

Results

Of the 37 cases, 32 were males and 5 were females. The average age was 26 years (range, 20–56 years). UPJO was on the left side in 22 cases and on the right side in 15 cases. The average follow-up was 38 months (range, 6–54 months). The operation duration was between 50 and 90 minutes (average = 65 minutes) and length of incision was 5.2 cm (range, 5–7 cm). Visual analogue pain scores obtained 4 and 24 hours after the operation were 4.1 ± 3.1 and 3.3 ± 3.4 , respectively. The average hospitalization time was 42 hours (range, 30–120 hours). Follow up of patients revealed a recurrent ureteropelvic stenosis in one case requiring reoperation, upper urinary dilatation with response to diuretics in 9 cases and radiological and functional recovery in 29 cases (Fig. 2).

Pain due to UPJO was relieved in 26/27 patients and the only case in whom the pain was not relieved in, had restenosis and was reoperated on after 3 months, with functional recovery (Table 1).

Discussion

Open surgery has a 90–95% success rate in the treatment of UPJO in a large clinical series [3], however there was a predilection to less invasive methods in recent years [4–6]. Unfortunately, the success rates of these antegrade or retrograde endoscopic procedures are lower than for open surgery [7,8].

Although laparoscopic pyeloplasty is almost identical to open surgery, it still remains largely dependent on technical equipment and experience, preventing it from being applicable in all centers. Therefore, open surgery is still one of the most preferred alternatives [9,10]. The only criticizable side of the open surgery is a painful surgical incision and longer hospitalization durations [11]. However, there are some studies attempting to overcome this disadvantage through modifying the surgical incisions. Önel

Table 1 Analyses of 37 cases who received dismembered pyeloplasty.

| | |
|---|-------------------|
| <i>n</i> | 37 |
| Average age (y) | 26 (20–56) |
| Side | 22 left, 15 right |
| Preoperative pain | 27 |
| Average operation time (min) | 65 (50–90) |
| Average length of incision (cm) | 5.2 (5–7) |
| Aberrant vessels | 8 |
| Average postoperative pain score at 4 th hour | 4.1 ± 3.1 |
| Average postoperative pain score at 24 th hour | 3.3 ± 3.4 |
| Hospitalization (h) | 42 (30–120) |
| Fail (re-operation) | 1 case |

et al. [12] decreased the average hospitalization durations to 30 hours with dorsal lumbotomy incision, and reported that shorter hospitalization periods and less postoperative pain makes the method preferable. They also stated that the surgical scar is minimized with the horizontal incision compared to the vertical incision, and better visualization is acquired compared to flank incisions performed through muscles. We had previously observed that the incisional scar did not constitute a problem in operations performed through dorsal lumbotomy incisions. However, dorsal lumbotomy is minimally invasive, and it is obvious that this is rather an unusual way for urology surgeons to access the retroperitoneal area. We did not experience any difficulty at exposing the ureteropelvic junction in our cases through this incision.

In flank incisions, all three layers of abdominal muscles are incised, with an incision reaching 15 cm, which might result in poor cosmetic results and extreme postoperative pain. Also, Bayazit et al. [13] acquired excellent results in favor of dorsal lumbotomy, compared to flank incision, in 100 cases, for hospitalization duration and postoperative pain. Furthermore, pleura might be surgically opened if the excision of the 11th rib is performed [13]. In another pyeloplasty series with laparoscopic and dorsal lumbotomy

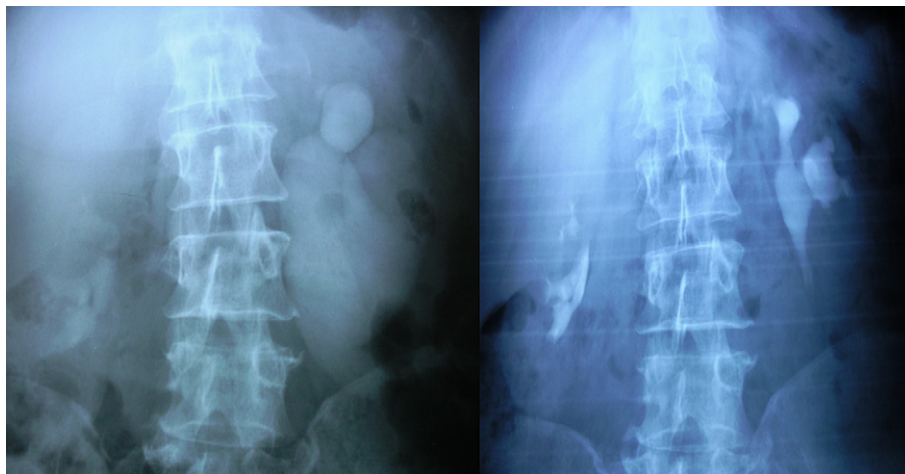


Figure 2. Preoperative and postoperative intravenous excretory urography at 6 months after pyeloplasty.

incisions performed in the same center, operation duration was found to be shorter in favor of dorsal lumbotomy incision, while hospitalization durations were similar [14].

In our modified flank incision, abdominal muscles were separated instead of incised. The length of incision was limited to 5 cm at the beginning of the operation extended up to 7 cm. This vertical method through the narrow incision helps to overcome the surgical difficulties at deep levels.

The main instruments (acutenaculum, portegu, scissors, dissectors, etc.) are held similarly to handling a puppet, to localize the instruments and surgeon's hands close to the surgery aspect. An additional advantage of this method is the possibility of the surgeon placing his/her elbows on the patient to minimize trembling. This is important at the point of suturing, in case the tissue is fragile. The surgeon does not need to lean forward and consequently, his body is not close to the surgical area; also with this method, the surgical area is more easily observed by the assistant for training purposes. A small incision, surgery in the retroperitoneum, muscle separation and local anesthetic (bupivacaine) injection at the incision, achieve significant benefits in postoperative pain palliation (Fig. 1).

Klingler et al. [15] compared the laparoscopic pyeloplasty results to those with flank incision and found better results in favor of the laparoscopic approach, with 6 days of hospitalization duration, a pain score of 3.5 on postoperative day 1, and a length of incision of 4 cm. In their open surgery series, the length of incision was 24 cm, hospitalization duration 14 days and the pain score was higher. Compared to our cases, the length of incision is longer. We believe that longer incision length adversely affected postoperative pain and hospitalization duration. Although the reason for a longer incision length is unclear, secondary cases might have influenced the surgeon's choice.

We applied the visual analogue scale 4 and 24 hours after the operation. The average visual analogue score at the

first postoperative day was found to be 3.3 and comparable to the pain scores of laparoscopic pyeloplasty reported in Klingler's study; this might be related to transperitoneal application of laparoscopic pyeloplasty [15]. However, the wider surgical area achieves the possibility of a transperitoneal approach, but leads to close contact with the intestines, which might result in chemical peritonitis, due to significant drainage from the anastomosis at the first day of the operation. This disadvantage results in much more pain and longer hospitalization duration, and was overcome with retroperitoneal laparoscopy methods.

Anastomosis under magnification in the laparoscopic approach, allows technical facilities, but thicker sutures like 4/0 might be a disadvantage. Nonetheless, the operation duration is the greatest drawback, reaching almost 300 minutes [2,16]. The operation durations in our cases were recorded between 50 and 90 minutes (average = 65 min), significantly shorter than the laparoscopic intervention reported [2,11,17]. This difference in durations might be the result of the long duration for preparation of laparoscopic instruments and a necessity of a long learning curve.

Hospitalization might be longer in classical pyeloplasty methods with longer and more traumatic incisions. Also, with the laparoscopic technique, this duration was reported with an average of 3–4 days (range, 3–14 days) [16]. The long hospitalization in laparoscopic pyeloplasty might be the result of anastomotic urine leakage and intestinal complications, especially in the transperitoneal approach. The average hospitalization in our cases was between 30 and 120 hours (average = 42 hours), and ureteral catheters were removed between the 20th and 35th days. Only one patient had to remain hospitalized for 5 days, due to anastomotic urine leakage prolonged to 4 days whom three months later re-operated again for a recurrent ureteropelvic stenosis. An open dismembered pyeloplasty was performed with functional recovery at the follow up. A comparison of the literature based studies, and our results, is shown in Table 2.

Table 2 Comparison of the results of three different methods in the literature (open pyeloplasty, laparoscopic pyeloplasty and our methods).

| | Surgical technique | Incision length (cm) | Operative time (min) | Hospitalization time (h) | Postoperative pain | Success (%) |
|----------------------|---------------------|------------------------|----------------------|--------------------------|---|-------------|
| Our results | Mini flank incision | 5–7 | 50–90 | 30–120 | Postoperative 4th h, VAS = 4.1 ± 3.1 Postoperative 24 h, VAS = 3.3 ± 3.4 good tolerance | 97 |
| Onol et al. [12] | Dorsal lumbotomy | 3–5 (Pediatric age) | 78 | 48 | good tolerance | 100 |
| Troxel et al. [17] | Laparoscopic | 4 | 110–180 | 72–144 | good tolerance | 96.8 |
| Cheema et al. [16] | Laparoscopic | 4 | 65–300 | 72–312 | good tolerance | 87 |
| Bansal et al. [11] | Laparoscopic | 3–4 | 188–300 | 48–168 | Diclofenac 107 mg | same |
| Klingler et al. [15] | Laparoscopic | 4.1 ± 0.7 | 244.2 (188–300) | 5.9 ± 2.1 | Postoperative day 1 VAS1 3.5 ± 1.6 Postoperative day 5 VAS5 0.9 ± 1.2 | 87.5 |
| Klingler et al. [15] | Flank incision | 23.1 ± 9.1 | 122 (100–140) | 13.4 ± 3.8 | Postoperative day 1 VAS1 5.4 ± 3.1 Postoperative day 5 VAS5 3.1 ± 1.8 | 93.3 |

We followed our patients with a diuretic renogram and IVU 3 and 6 months later. Pain disappeared entirely in 26/27 patients. Of the 37 cases, 28 presented almost entire radiological recovery. Pelvicaliectasis persisted in 9 patients, with no prominent obstruction and response to diuretics. The possible explanation for almost a 97% success rate, might be a tension free anastomosis, fine 6/0 monofilament surgical threads, no injury to the aberrant veins of the lower pole of the kidney, and a continuous suturing inverting the mucosal edges.

In conclusion, open surgical methods still remain the most reliable methods in surgical treatment of UPJO. Poor cosmetic results, long hospitalization durations, and extreme postoperative pain, may be overcome with minimally invasive techniques.

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